

Chapter 9: Cellular Reproduction

9.1 Cellular Growth

I. Cell size limitation

A. The key factor that limits the size of the cell is the ratio of its surface area to its volume

1. Ratio of surface area to volume is 6:1 for a cube

2. As a cell grows its volume increases much more rapidly than the surface area
→ see figure 2, p. 494

B. Transport of substances

1. Small cell size maximizes the ability of diffusion and motor proteins to transport nutrients and waste products.

2. Cellular communications - the need for signaling proteins to move throughout the cell also limits cell size

a. If a cell becomes too large, cell communication can become extremely difficult

II. The cell cycle - the process by which cells reproduce by growing and developing

→ see Figure 11, p. 497 for description of the three stages of the cell cycle:
interphase, mitosis, and cytokinesis

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A. Interphase - stage of the cell cycle where cell grows and DNA is replicated for division

1. 3 sub stages: $S_1 \rightarrow G \rightarrow S_2$

B. Mitosis - stage of the cell cycle during which cell's nucleus and nuclear material divide

1. Mitosis has four substages:

prophase; metaphase, anaphase, telophase

C. Cytokinesis - the method by which a cell's cytoplasm divides; form two new cells

D. Chromosomes - structures that contain the genetic material for heredity

1. Chromatin - the relaxed (condensed) form of DNA in the cell's nucleus

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9.1 Review

Grade: 10th
Subject: Biology
Date: 1/15/13

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- 1 Cells decrease in surface area to volume ratio as the cell size increases

True
False

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2 What aspect of cell function involves moving substances and signals among organelles?

- A apoptosis
- ☒ B cellular communication
- C mutation
- D cytokinetic signals

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3 The method by which a cell's cytoplasm divides is called _____.

- A DNA replication
- B interphase
- C mitosis
- D cytokinesis

Jan 15-9:50 AM

4 Which of these is not an example of how substances move within cells?

- A cytoskeleton network
- ☒ B cell cycle
- C motor proteins
- D diffusion

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5 Why would diffusion be more inefficient in a large cell?

- A it relies on motor proteins
- ☒ B it relies on random movement of particles
- C it relies on DNA mutations
- D it relies on checkpoints in cell cycle

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Jan 15-9:54 AM

9.2 Mitosis and Cytokinesis

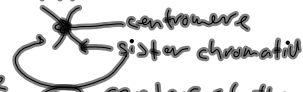
→ Main idea: Eukaryotic cells reproduce by mitosis, the process of nuclear division and cytokinesis, the process of cytoplasm division

I. Mitosis: a key activity of Mitosis is the accurate separation of the cells replicated DNA into two identical daughter cells

II Stages of Mitosis (See Figure 9, p. 505)

(1) A. Prophase - 1st and longest stage of Mitosis

1. Chromatin condenses into chromosomes that form an X
2. Centromere. structure chromosome; ensures that the DNA becomes part of daughter cells
3. Nucleolus disappears; nuclear membrane disintegrates
4. Spindle apparatus forms between poles (microtubule structures)
 - a. centrioles, microtubule structures, move to ends, or poles of the cell



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(2) B. Metaphase

1. Chromosomes attach to spindle apparatus and align along the cell equator (middle of cell)

(3) C. Anaphase - chromatids are pulled apart

1. Microtubules shorten, moving chromosomes to opposite poles

(4) D. Telophase - chromosomes arrive at the poles of the cell and to begin to relax and decondense

1. Two new nuclear membranes begin to form and the nuclei reappear; nucleolus reappears
2. Spindle apparatus disassembles

E. Cytokinesis begins after telophase; cytoplasm ^{divides} along the furrow resulting in two identical daughter cells

F. In plant cells, a cell plate forms between the two daughter cell's nuclei during cytokinesis

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9.2 Review

Grade: 10th
Subject: Biology
Date: 1/16/13

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1 The phase of cell division in which chromatin condenses into chromosomes is _____.

- A telophase
- B anaphase
- C prophase
- D apoptosis

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2 The _____ contains spindle fibers, aster fibers, and centrioles.

- ☒ A spindle apparatus
- ☐ B centromeres
- ☐ C chromosome
- ☐ D nuclear envelope

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3 During metaphase, what are the structures that line up on the cell equator?

- ☐ A cyclins
- ☐ B single chromatids
- ☒ C chromosomes
- ☐ D kinases

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- 4 During anaphase (a phase of mitosis) the sister chromatids that aligned on the cell equator during metaphase begin to pull apart.

Pro, Meta, Ana, telo

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- 5 Which of these events do not occur during telophase?

- A chromosomes align at the cellular poles
- ☒ B cytoplasm splits into two
- C chromosomes relax
- D spindle apparatus disassembles

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6 The cell cycle consists of three distinct stages: interphase, mitosis, and cytokinesis. Mitosis is the longest stage of the cell cycle. *Interphase*

True

False

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9.3 Cell Cycle Regulation

→ Main idea: the normal cell cycle is regulated by cyclin proteins

I. Normal Cell Cycle

A. The timing and rate of cell division are important to health of an organism; proteins and enzymes controls cell cycle rate

B. The role of cyclins (Figure 6.1 p. 512)

1. Cyclins - proteins that bind to cyclin-dependent kinases (CDKs) during interphase and mitosis

a. starts signaling to begin cell reproduction

C. Quality control checkpoints

1. Cell cycle has built in checkpoints to prevent abnormal cells from being produced

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- II Abnormal Cell Cycle: Cancer
- A. Cancer - the uncontrolled growth and division of cells
1. Cancer results from failure in regulation of the cell cycle
- B. Causes of Cancer

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9.3 Review

Grade: 10th
Subject: Biology
Date: 1/22/13

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1 What can result from improper regulation in the cell cycle?

- A cancer
- B apoptosis
- C control checkpoints
- D mitosis without a prophase

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2 Substances known to cause cancer are called _____.

- A kinases
- B carcinogens
- C stem cells
- D aster fibers

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3 After fertilization, a mass of unspecialized cells called _____ form.

- A nerve cells
- B embryonic stem cells
- C cardiac cells
- D apoptosis cells

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4 What would happen if cyclins did not function properly in the cell cycle?

- A cell cycle would not start
- B rapid cell division would occur
- C cyclin-dependent kinases would start cell cycle
- D rapid mutation would occur

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5 A process called apoptosis is essentially programmed cell death.

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